Fundamental Studies on Cooking of Wood. (IV) : Soda Cooking

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19. Photochemistry of Cellulose. (III)

Effect of Wavelength under Consideration of Effect of Oxygen.

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The chromatic dependence in the photodegradation of cellulose by ultraviolet rays was observed under consideration of oxygen effect. As the light source, a low vapor pressure mercury arc lamp was employed.

The foreground of interest is the determination of effective spectral region for the photolysis of cellulose. It was found, under the present conditions of experiments, that the rays having wavelengths greater than 3000 Å showed no practical influence upon cellulose whose degradation was measured by cuprammonium D. P. On the other hand, cellulose was intensely affected by the rays having wavelengths smaller than 3000 Å.

The rays radiated from the mercury lamp in the spectral region below 3000 Å are mainly composed of two groups of lines whose centers are situated at 2537 Å and 1850 Å respectively. Of interest is the comparison of effects these line groups. The line group of 1850 Å can be cut off by a filter of 0.5% acetic acid solution having thickness of 1 cm. The filter transmits all other rays. Therefore, the irradiation through this filter represents the effect of 2537 Å only, while the bare rays bring about the summed effect of two groups, namely 2537 Å + 1850 Å. The effect of 1850 Å alone can be estimated by subtracting the effect of 2537 Å from the summed effect.

D. P. — time of exposure curves were obtained using oxygen pressure as a parameter. It was found that the degrading effect of 2537 Å is enhansed by increasing the oxygen pressure. This suggests that oxygen participates in the photolytic degradation of cellulose by the rays having greater wavelengths. On the contrary, the effect of 1850 Å was apparently decreased by increasing the pressure of oxygen. The negative effect of oxygen at the irradiation by 1850 Å may possibly be ascribed intensity diminution of the light due to the absorption by oxygen. When the intensity decrease is corrected by the Lambert-Beer's law, the degradation per unit light intensity is almost independent of oxygen pressure.

These results may represent the possibility that the primary process of 1850 Å upon cellulose would be the primary dissociation, while the rays of 2537 Å would produce primarily the photochemical activated molecules which are degraded by the ensuing action of oxygen.

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20. Fundamental Studies on Cooking of Wood. (IV)

Soda Cooking

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The thin slices (longitudinal sections) of about 200 μ thickness of the spruce (Ezomatsu from Hokkaido) were cooked by the soda process. The removed amount of lignin, pentosan and cellulose, changes in D. P. of the cellulose and mechanical properties of residues (the residues themselves as well as the products delignified by means of $NaClO_2$) were determined at the various stages of cooking and compared with sequence in the case of the sulfate cooking, which was reported in the previous paper.

The rates of the cooking reaction and of the consumption of effective alkali during soda cooking are much slower than in the case of sulfate cooking, but the removed amount of lignin, pentosan and cellulose for same yield of residues are almost the same, irrespective of the cooking processes throughout the whole stages of cooking. The D. P. 's and the values representing the mechanical properties of delignified soda pulp reach a maximum point at a high yield such as about 80% and then begin to fall gradually with decreasing yields of residues. This is very different from the case of sulfate process where the maximum value of D. P. and maximum mechanical strength was found to happen at a yield of about 45—50 %. The residues having such a yield could easily be defibrilated. Therefore, the mechanical properties of soda pulp having a yield of 45—50 % are always much inferior to those of the sulfate pulp having the same yield.

The more remarkable degradation of cellulose at the later stage of soda cooking would be due to the fact that it has been exposed to a stronger effective alkali for a longer period of time at a high temperature. This will account for the smaller D.P. 's and lower values of strength of soda pulp than those of sulfate pulp.

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21. Study on the Continuous Alkali Cellulose Shredder

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Continuous shredders used for alkali cellulose such as J.B. or Eirich type which is now being adopted industrially in many viscose rayon mills, have several defects as follows :

1) Generally speaking, the shredded state of alkali cellulose is ununiform and its particle has many cores.

2) The alkali cellulose adheres to the inside of shredder and the cellulose is dried by air and this becomes the cause of free fibers which obstruct the filtration of viscose.

3) The temperature of alkali cellulose is raised during the crushing, and thus